Confirmation No. 3088

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	HESEN, *et al.*	Examiner:	Chhaya, S.
Serial No.:	10/560,447	Group Art Unit:	2822
Filed:	December 12, 2005	Docket No.:	NL030692US1
Title:	LEAD FRAME, METHOD OF MANUFACTURING A SEMICONDUCTOR DEVICE		

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Customer No.
65913

Dear Sir:

This Appeal Brief is submitted pursuant to 37 C.F.R. §41.37, in support of the Notice of Appeal filed July 8, 2008 and in response to the rejections of claims 1-10 and 12-16 as set forth in the Final Office Action dated February 12, 2008, and in further response to the Advisory Action dated June 16, 2008.

Please charge Deposit Account number 50-0996 (NXPS.316PA) $510.00 for filing this brief in support of an appeal as set forth in 37 C.F.R. §1.17(c). If necessary, authority is given to charge/credit Deposit Account 50-0996 additional fees/overages in support of this filing.

I. Real Party In Interest

The real party in interest is NXP Semiconductors. The application is presently assigned of record, at reel/frame nos. 017369/0523 to NXP, B.V., headquartered in Eindhoven, the Netherlands.

II. Related Appeals and Interferences

While Appellant is aware of other pending applications owned by the above-identified Assignee, Appellant is unaware of any related appeals, interferences or judicial proceedings that would have a bearing on the Board's decision in the instant appeal.

III. Status of Claims

Claims 1-10 and 12-16 stand rejected and are presented for appeal. Claim 11 has been cancelled and does not form part of this appeal. A complete listing of the claims under appeal is provided in an Appendix to this Brief.

IV. Status of Amendments

All amendments have been entered, and no amendments were presented subsequent to the Final Office Action. As such, the claims appearing in the Appendix to the Brief reflect the claims as presented on October 31, 2007.

V. Summary of Claimed Subject Matter

Appellant's invention is related to lead frames and methods of making electroconductive connections, for example to semiconductor elements, using lead frames.

Commensurate with independent claim 1, an example embodiment of the present invention is directed to a lead frame (*see, e.g.*, lead frame 11 in Figs. 1-5, along with page 7:26 through page 8:9) provided with a frame (*see, e.g.*, frame 11A in Figs. 1-5, along with page 7:26 through page 8:9) having a first and a second connection conductor, which connection conductors are each connected to the frame and provided with a non-engaging end portion (*see, e.g.*, connection conductors labeled 4, 4A and 5, 5A, 5B in Figs. 1-5, along with page 7:26 through page 8:9), the end portion of the second connection conductor within

the frame being positioned outside the extension of the first connection conductor (*see, e.g.*, Figs. 1-5, along with page 7:26 through page 8:9), the second connection conductor adapted to deform such that, by bending along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion, the end portion of the second connection conductor can be positioned opposite the first connection conductor (*see, e.g.*, Figs. 1-5, along with page 8:10-31), and a semiconductor element can be placed between said connection conductors (*see, e.g.*, semiconductor element 3 shown placed in Fig. 4, along with page 8:32 through page 9:8).

Commensurate with independent claim 3, another example embodiment of the present invention is directed to a method of manufacturing a semiconductor device, which includes the steps of providing a semiconductor element having a first and a second electric connection region which connection regions are situated at opposite sides of the semiconductor element (*see, e.g.*, semiconductor element 3 shown in Figs. 1-5, along with page 8:32 through page 9:8); providing a lead frame commensurate with the lead frame recited in claim 1 and its dependent claims; and fitting the semiconductor element between the end portions of the first connection conductor, where connection means are used to make electroconductive connections between the connection regions and the end portions (*see, e.g.*, Figs. 2, 4, 5 and 9, along with page 8:32 through page 9:8).

Commensurate with independent claim 4, an example embodiment of the present invention is directed to a method of manufacturing a semiconductor device, which includes the steps of providing a semiconductor element having a first and a second electric connection region, which connection regions are situated on opposite sides of the semiconductor element (*see, e.g.*, semiconductor element 3 shown in Figs. 1-5, along with page 8:32 through page 9:8); providing a lead frame commensurate with the lead frame recite in claim 1 and its dependent claims; applying the semiconductor element to the end portion of the first connection conductor, an electroconductive connection between the first connection region and the end portion being made by using a connection means (*see, e.g.*, page 8:32 through page 9:31); moving the end portion of the second connection conductor to a position outside the plane of the frame and opposite a location for the second connection region of the semiconductor element (*see, e.g.*, page 8:32 through page 9:31); making an

electroconductive connection between the second connection region and the end portion of the second connection conductor by using a connection means (*see, e.g.*, page 8:32 through page 9:31).

Commensurate with independent claim 10, an example embodiment of the present invention is directed to a device for carrying out a method such as recited in claims 3 or 4, the device including a transport mechanism (*see, e.g.*, Figs. 7-9 generally, along with page 11:1-22) for a lead frame with at least two connection conductors; positioning means (*see, e.g.*, Figs. 7-9 generally, along with page 11:1-22) for positioning a semiconductor element; pusher means (*see, e.g.*, Figs. 7-9 generally, along with page 11:1-22) for pushing the semiconductor element in between the two connection conductors, of which one is bent to a position above the position of the other one; and means for bending an end portion of at least one of the connection conductors along a bending axis which makes an oblique angle with the longitudinal axis of the end portion (*see, e.g.*, Figs. 7-9 generally, along with page 11:1-22).

Commensurate with independent claim 13, an example embodiment of the present invention is directed to a semiconductor device that includes a semiconductor element which is provided with a first and a second electric connection region, which connection regions are situated on opposite sides of the semiconductor element (*see, e.g.*, semiconductor element 3 shown in Figs. 1-5, along with page 8:32 through page 9:8); a first connection conductor having a contact, and facing away therefrom an end portion which is electroconductively connected to the first connection region (*see, e.g.*, semiconductor element 3 shown in Fig. 4 connected to first connecting region 4A, along with page 9:9-31); a second connection conductor having a contact, and facing away therefrom, an end portion which is bent along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion, such that the end portion is situated opposite the second electric connection region, with which it is electroconductively connected, while the contact is situated in the same plane as the contact of the first connection conductor (*see, e.g.*, bent connecting conductors 5A and 5B shown in Fig. 4, along with page 9:9-31); and an isolating envelope which leaves contacts facing way from the end portions of the connection conductors uncovered (*see, e.g.*, envelope 9 shown in Fig. 6, along with page 10:28-34).

As required by 37 C.F.R. § 41.37(c)(1)(v), a concise explanation of the subject matter defined in the independent claims involved in the appeal is provided herein. Appellant notes that representative subject matter is identified for these claims; however, the abundance of supporting subject matter in the application prohibits identifying all textual and diagrammatic references to each claimed recitation. Appellant thus submits that other application subject matter, which supports the claims but is not specifically identified above, may be found elsewhere in the application. Appellant further notes that this summary does not provide an exhaustive or exclusive view of the present subject matter, and Appellant refers to the appended claims and their legal equivalents for a complete statement of the invention.

VI. Grounds of Rejection to be Reviewed Upon Appeal

The grounds of rejection remaining to be reviewed on appeal are as follows:

A. Claims 1-7, 9-10, 12-13 and 15-16 stand rejected under 35 U.S.C. § 102(b) over the Heinlen reference (U.S. Patent 3,736,367).

B. Claims 8 and 14 stand rejected under 35 U.S.C. § 103(a) over the Heinlen reference in view of the Sakamoto reference (U.S. Patent No. 6,975,022).

VII. Argument

Appellant requests that the Board reverse the rejections of all pending claims 1-10 and 12-16 for the reasons discussed below. In particular, Appellant submits that the Heinlen reference, on which each of the rejections is based, fails to teach or suggest all the features recited in Appellant's claims, and instead demonstrates the type of multiple right-angle bending steps that may be avoided by use of Appellant's invention.

A. The § 102(b) rejection of claims 1-7, 9-10, 12-13 and 15-16 is improper because the Heinlen reference fails to teach all the features recited in Appellant's claims.

The Heinlen reference includes no teaching or disclosure to correspond to the claimed aspects directed to the end portion of the second connection conductor being brought to a position opposite the position of the semiconductor element by bending along a bending axis that is at an oblique angle (*i.e.,* an angle other than a right angle) with respect to the longitudinal axis of the end portion.

Heinlen demonstrates a specific series of bends, each being around a bending axis that is perpendicular to the longitudinal axis of the portion being bent. *See, e.g.*, Figs. 2-5. In a first bending step, illustrated in the progression from Fig. 2 to Fig. 3, contact arm 20 is bent upward at bend 50, which is along an axis that is perpendicular to the longitudinal axis of the arm 20. In a next bending step, illustrated in the progression from Fig. 3 to Fig. 4, the arm 18 is bent upward at bend 54, which is along an axis that is perpendicular to the longitudinal axis of the arm 18. In a final bending step, illustrated in the progression from Fig. 4 to Fig. 5, the arm 18 is bent downward at bend 60, which is along an axis that is perpendicular to the longitudinal axis of the arm 18. *See also,* Col. 3:38-50. None of the bends shown by Heinlen are around a bending axis that is at an oblique angle with respect to the longitudinal axis of the portion being bent, as claimed. Accordingly, the § 102(b) rejection is improper.

To promote a clear and unequivocal understanding that all of Heinlen's bending axes form right angles with the longitudinal axis of the bent portion, Appellant reproduces Heinlen's Figs. 2-4 below in a manner that indicates the bending axes (bold arrows) and the

longitudinal axes (dashed arrows). For the sake of clarity, the reproductions below differ from those provided in Appellant's Response of April 14, 2008 in that all the bending and longitudinal axes are referenced to a bend that is about to be made.

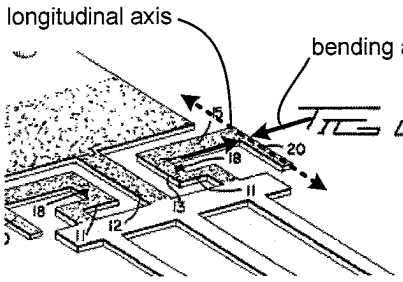


FIG 2

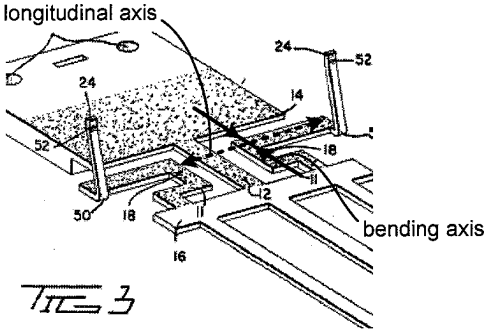


FIG 3

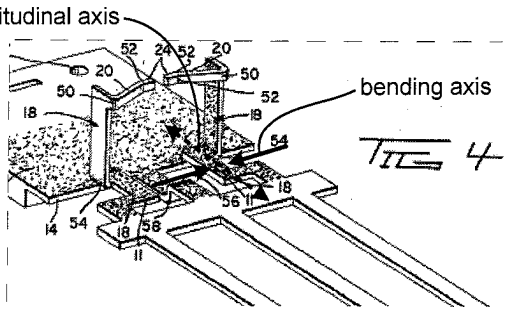


FIG 4

As can be seen in Figs. 2-4, the Heinlen reference demonstrates a specific series of bends, each being around a bending axis that is perpendicular to the longitudinal axis of the portion being bent.

In response to Appellant, the Examiner has stated that, "[u]sing the same logic as provided by the applicant, the bending axis provided by applicant's drawings, namely Fig. 3-4, would also be along a perpendicular axis." See Final Office Action dated February 12, 2008, from the bottom of page 13 to the top of page 14. This statement is demonstrably untrue by simple inspection of Appellant's Figs. 3 and 4, which are reproduced below in a

manner that indicates the bending axis (bold arrows) and longitudinal axis (dashed arrows) forming a non-right, oblique angle.

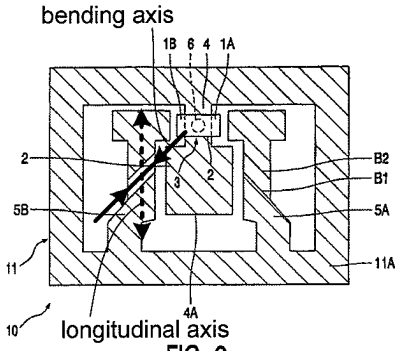


FIG. 3

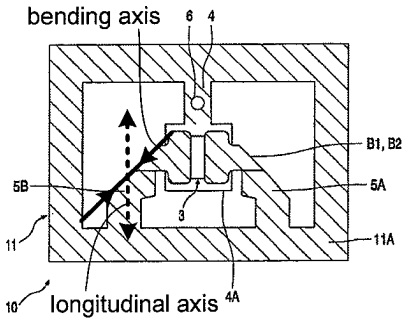


FIG. 4

Despite Appellant's efforts to explain the differences between the Heinlen reference and the claimed subject matter, the Examiner has maintained the § 102(b) rejection by continuing to misinterpret Heinlen as teaching bending around a bending axis that is at an oblique angle with respect to the longitudinal axis of the portion being bent. Appellant surmises that the Examiner is confusing the angular arc through which the bend is being made with the angle formed between the bending axis and the longitudinal axis. The distinction between a bending arc and the angle between the bending axis and the longitudinal axis may be illustrated with reference to Appellant's Fig. 4 where it can be seen that the bent portion has been completely folded over to form a bending arc of approximately 180°, whereas the angle between the bending axis and the longitudinal axis is approximately 45°. It should be noted that Appellant's arguments have drawn no conclusions as to the angular arc of the bends demonstrated by Heinlen. Appellant submits that the angular arc of the bends is not relevant to the issues presented, primarily because Appellant's claims do not

recite the amount of bending, but rather the angle that is formed between the bending axis and the longitudinal axis of the portion being bent.

For at least these reasons, Appellant submits that the § 102(b) rejection is improper because the Heinlen reference clearly fails to disclose all the features recited in Appellant's claims. Appellant therefore requests that the § 102(b) rejection be reversed.

B. The § 103(a) rejection of claims 8 and 14 is improper because the proposed combination of Heinlen and Sakamoto fails to teach or suggest all the features recited in Appellant's claims.

Appellant respectfully submits that the § 103(a) rejection of claims 8 and 14 is improper because the Heinlen reference does not correspond to the claimed invention as discussed above, and because the Sakamoto reference provides no teaching to overcome these deficiencies. The Examiner admits that Heinlen fails to teach a semiconductor element being placed on a hole and fixed using suction and pushing. However, any alleged disclosure by Sakamoto of such features does not address the deficiencies of Heinlen, as noted above.

Moreover, the Sakamoto reference relates to wire bonding of semiconductor elements to mounting areas, and appears to be unrelated to connections made by lead frame bending such as disclosed by Heinlen. Nor has the Examiner provided any basis for concluding why or how any mounting aids disclosed by Sakamoto for wire bonding could be addressed to the lead frame bending of Heinlen. Appellant therefore submits that no valid reason has been presented for why one of skill in the art would seek to make the proposed combination.

For at least these reasons, Appellant submits that the § 103(a) rejection of claims 8 and 14 is improper and requests it be reversed.

VIII. Conclusion

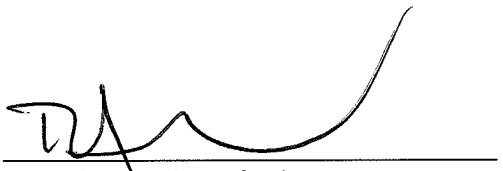
In view of the above, Appellant submits that the rejections of claims 1-10 and 12-16 are improper and therefore requests reversal of the rejections as applied to the appealed claims and allowance of the entire application.

Authority to charge the undersigned's deposit account was provided on the first page of this brief.

Please direct all correspondence to:

Corporate Patent Counsel
NXP Intellectual Property & Standards
1109 McKay Drive; Mail Stop SJ41
San Jose, CA 95131

CUSTOMER NO. 65913

By: 
Name: Robert J. Crawford
Reg. No.: 32,122
651-686-6633
(NXPS.316PA)

APPENDIX OF CLAIMS INVOLVED IN THE APPEAL
(S/N 10/560,447)

1. A lead frame provided with a frame having a first and a second connection conductor, which connection conductors are each connected to the frame and provided with a non-engaging end portion, the end portion of the second connection conductor within the frame being positioned outside the extension of the first connection conductor, the second connection conductor adapted to deform such that, by bending along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion, the end portion of the second connection conductor can be positioned opposite the first connection conductor, and a semiconductor element can be placed between said connection conductors.

2. A lead frame as claimed in claim 1, characterized in that the end portion of the second connection conductor has been brought to a position opposite the position of the semiconductor element by bending along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion.

3. A method of manufacturing a semiconductor device comprising the steps of:

- providing a semiconductor element having a first and a second electric connection region which connection regions are situated at opposite sides of the semiconductor element;
- providing a lead frame as claimed in claim 2; and
- fitting the semiconductor element between the end portions of the first connection conductor, where connection means are used to make electroconductive connections between the connection regions and the end portions.

4. A method of manufacturing a semiconductor device comprising the steps of:

- providing a semiconductor element having a first and a second electric connection region, which connection regions are situated on opposite sides of the semiconductor element;

- providing a lead frame having a frame with a first and a second connection conductor, which connection conductors are each connected to the frame and provided with an exposed end portion;

- applying the semiconductor element to the end portion of the first connection conductor, an electroconductive connection between the first connection region and the end portion being made by using a connection means;

- moving the end portion of the second connection conductor to a position outside the plane of the frame and opposite a location for the second connection region of the semiconductor element,

- making an electroconductive connection between the second connection region and the end portion of the second connection conductor by using a connection means,

characterized in that the end portion of the second connection conductor within the frame is positioned outside the extension of the first connection conductor and is brought to a position opposite the position for the second connection region of the semiconductor element by bending along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion.

5. A method as claimed in claim 4, characterized in that the end of the end portion of the second connection conductor is bent through approximately 90 degrees along the bending axis out of the plane of the frame, and the end of the end portion is bent, along a further bending axis extending substantially parallel to the bending axis and at a distance therefrom corresponding approximately to the thickness of the semiconductor element, through an angle of approximately 90 degrees to the position of the semiconductor element.

6. A method as claimed in claim 5, characterized in that the end portion of the second connection conductor is bent along the further bending axis or along another bending axis in such a manner that said end portion extends obliquely in at least one direction with respect to the end portion of the first connection conductor which contains the position for the semiconductor element.

7. A method as claimed in claim 4, characterized in that the semiconductor element is slid between the connection conductors after the end portion of the second connection conductor has been bent to a position opposite the location for the second connection region of the semiconductor element and opposite the end portion of the first connection conductor, the element being clamped between the connection conductors.

8. A method as claimed in claim 3, characterized in that

- a lead frame is chosen in which the first connection conductor is provided with a hole at a distance from the position of the semiconductor element;

- the semiconductor element is placed on the hole and fixed by means of a suction device present below the hole, after which the semiconductor element is pushed between the connection conductors by means of a pusher member.

9. A method as claimed in claim 3, characterized in that before the semiconductor element is slid between the connection conductors, the end portion of the first connection conductor is maintained in a depressed position by means of a pressure member, until the semiconductor element has been slid between the connection conductors.

10. A device for carrying out a method as claimed in any one of claims 3 through 9, characterized in that the device comprises:

- a transport mechanism for a lead frame with at least two connection conductors;

- positioning means for positioning a semiconductor element;

- pusher means for pushing the semiconductor element in between the two connection conductors, of which one is bent to a position above the position of the other one; and

means for bending an end portion of at least one of the connection conductors along a bending axis which makes an oblique angle with the longitudinal axis of the end portion.

12. A device as claimed in claim 10, characterized in that it comprises pressure means for pressing downward one of the conductor tracks, during the pushing against the semiconductor element.

13. A semiconductor device comprising:

- a semiconductor element which is provided with a first and a second electric connection region, which connection regions are situated on opposite sides of the semiconductor element;

- a first connection conductor having a contact, and facing away therefrom an end portion which is electroconductively connected to the first connection region;

- a second connection conductor having a contact, and facing away therefrom, an end portion which is bent along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion, such that the end portion is situated opposite the second electric connection region, with which it is electroconductively connected, while the contact is situated in the same plane as the contact of the first connection conductor; and

- an isolating envelope which leaves contacts facing way from the end portions of the connection conductors uncovered.

14. A semiconductor device as claimed in claim 13, characterized in that:

- the semiconductor element is a semiconductor diode;

- the second connection conductor is u-shaped or j-shaped prior to bending,

- for the oblique angle, an angle in the range between 70 and 80 degrees is selected, and

- the contacts of the connection conductors are in line with one another.

15. A semiconductor device as claimed in claim 13, characterized in that:

- the semiconductor element is a semiconductor transistor with a third connection region; and

- a third connection conductor is present, which has a contact, and facing away therefrom, an end portion which is bent along a bending axis which is at an oblique angle with respect to the longitudinal axis of the end portion, such that the end portion is situated opposite the third electric connection region, with which it is electroconductively connected,

while the contact is situated in the same plane as the contact of the first connection conductor;

- the second and the third connection conductor are situated on either side of the first connection conductor.

16. A semiconductor device as claimed in claim 13, or a lead frame as claimed in claim 1, characterized in that the first connection conductor is provided with a hole at a distance from the position for the semiconductor element.

APPENDIX OF EVIDENCE

Appellant is unaware of any evidence submitted in this application pursuant to 37 C.F.R. §§ 1.130, 1.131, and 1.132.

APPENDIX OF RELATED PROCEEDINGS

As stated in Section II above, Appellant is unaware of any related appeals, interferences or judicial proceedings.